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CNTPLT DOCUMENTATION - A POST-PROCESSOR FOR INTERPRETING MINTAB (Version 2.0, 1981) RESULTS

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INTRODUCTION

This report documents a plot program which was developed to provide graphical representation of results obtained from the execution of MINTAB Program (1). Two types of plots are available each providing a specific symbolic representation of certain data.

The program is very easy to use because the input procedure is very flexible. Other features of this program is that any number of plots may be done. It can be pre-viewed interactively on the Tectronix graphic display console using TEKCAL, a Tektronix Calcomp preview routine developed at MRL before it is plotted on a Calcomp plotter. Hard copy of these plots can also be done from an electrostatic VERSATEC hard copy/printer which is interfaced with Tektronix 4010 terminal.

The language of the program is standard Fortran IV. All the basic plotting routines used are Calcomp software.

GENERAL INFORMATION

The following examples illustrate the two types of plots which can be obtained from the program CNTPLT. Some of the terminology used in this report follows very closely with those as described in the MINTAB Program (1).

PLOTTING SIZE

The plotting size of point-contour maps and that of the graphs for different quantities are specified by PLTSIZ, AXLENX and AXLENY respectively as shown in Fig. 1 and 2. They are all in potting inches for Calcomp plotter. For point-contour-maps, PLTSIZ = 6.5 (inches) is a reasonable size for a 80 x 80 grid.

For graphs along any section within the grid, AXLENX = 6.5 and AXLENY = 5.0 seemed to be working very well. However, they are not restricted to those values as specified and it is very flexible and can be any size or dimension as the requirements demand.

SCALING

Scaling applies only to graph-plotting.

A proper scale will be selected by the program for each quantity to be plotted. A total of nine quantities if all of them are to be plotted and they are:

DX DY DZ	rides/closure
SIGZZ SIGXX SIGYY	normal stresses
SIGXY SIGYZ SIGZX	shear stresses

The program searches for the maximum and the minimum values of a quantity from all the sections as specified by the user. Then an appropriate scale will be calculated based on the maximum , minimum values and the plotting size as the user specified. In this case the graphs for the same quantity will have the same scale for all the sections to be plotted.

INPUT DATA INSTRUCTIONS

Card Group	No. of cards	Data and Definition	Format
1.0		Plot control parameters this card controls the selection of plots and their plotting size.	

Card Group	No. of cards	Data and Definition	Format
1.1	1	ELMSIZ, PLTSIZ, AXLENX, AXLENY, NCPLT	4F10.2, I5
		ELMSIZ = Size of small squares of the mine grid in logical unit.	
		PLTSIZ = Plotting size of the point contour maps; the maximum dimension of contour map along any direction is specified. The unit is in plotting inches (see Fig. 1).	
		AXLENX = The length of x-axis for graph plotting (see Fig. 2).	
		AXLENY = The length of y-axis for graph plotting (see Fig. 2).	
		NCPLT = Plotting options: if NCPLT = 0 no point contour maps will be done; if NCPLT > 0 point contour maps will be plotted.	
1.2	1	(ISTEP (II), II = 1.9)	9I1
		An array contains plotting indicator for mining steps. A maximum of nine mining steps is allowed. If ISTEP(II) = 0, no plots (either contour maps or graphs) will be initiated for the mining step II. If ISTEP (II) >0, plots will be done for the mining step II.	

Card Group	No. of cards	Data and Definition	Format
1.3	1	(IPOLT (JJ), JJ = 1,11)	11I1

CNTPLT has provision to produce contour maps up to 11 different quanities. If IPLOT (JJ) is non-zero their quantity will be plotted. Otherwise it will not. The various quantities which can be plotted are listed below. Note that all quantities that can be plotted are those calculated in the seam and are in reef coordinates.

IPLOT (1) = The ride component in x direction, DX.
IPLOT (2) = The ride component in y direction, DY.
IPLOT (3) = The closure in Z direction, DZ.
IPLOT (4) = Normal stress SIGZZ.
IPLOT (5) = Normal stress SIGXX.
IPLOT (6) = Normal stress SIGYY.
IPLOT (7) = Shearing stress SIGXY.
IPLOT (8) = Shearing stress SIGYZ.
IPLOT (9) = Shearing stress SIGZX.
IPLOT (10) = Energy release ENERGY.
IPLOT (11) = Strength/stress raito, S.S.R.
A point contour map of strength/ stress ratio is calculated based on an empirical strength criterion. User can easily modify the user-supplied rutine to adopt any other failure criterion.

Card Group	No. of cards	Data and Definition	Format
2.0		Point-contour-map information	
2.1	1	(NUMINT (KK), KK = 1,11)	
		NUMINT (KK) specifies the number of equal contour intervals into which the data range of quanty JJ will divide. The quantity KK is as defined in card 1.3. The maximum number of contours allowed for any plot is 35. The default number is 10. <u>If NCPLT = 0, skip this card and proceed to card group 3.0.</u>	
2.2	1	QU, XM, XS	3F10.2
		QU = Unconfined compressive strength in Mpa.	
		XM, XS = Constants defining the empirical strength equation. Some values are suggested by Hoek and Brown (Ref. 2).	
		<u>This card required only if IPLOT (11) is non-zero.</u>	
3.0		Information required for plotting graphs for section either along strike direction or dip direction or both.	
3.1	1	NUMSEC	I5
		NUMSEC = Total number of sections to be examined for graph plotting.	

Card Group	No. of cards	Data and Definition	Format
3.2		ISEC, I, J, K, L	4X, I1, 4I5

ISEC = Section definition.
ISEC = 1 defines a section along the stike direction.
ISEC = 2 defines a section along the dip direction.

I, J = The large square in the mine grid.

K, L = The small square in the mine grid.

For sections along the stike direction, set J = 1 and L = 1. For those along the dip direction, Set I = 1 and K = 1.

If NUMSEC = 0, this card(s) will not be required.

ACKNOWLEDGEMENTS

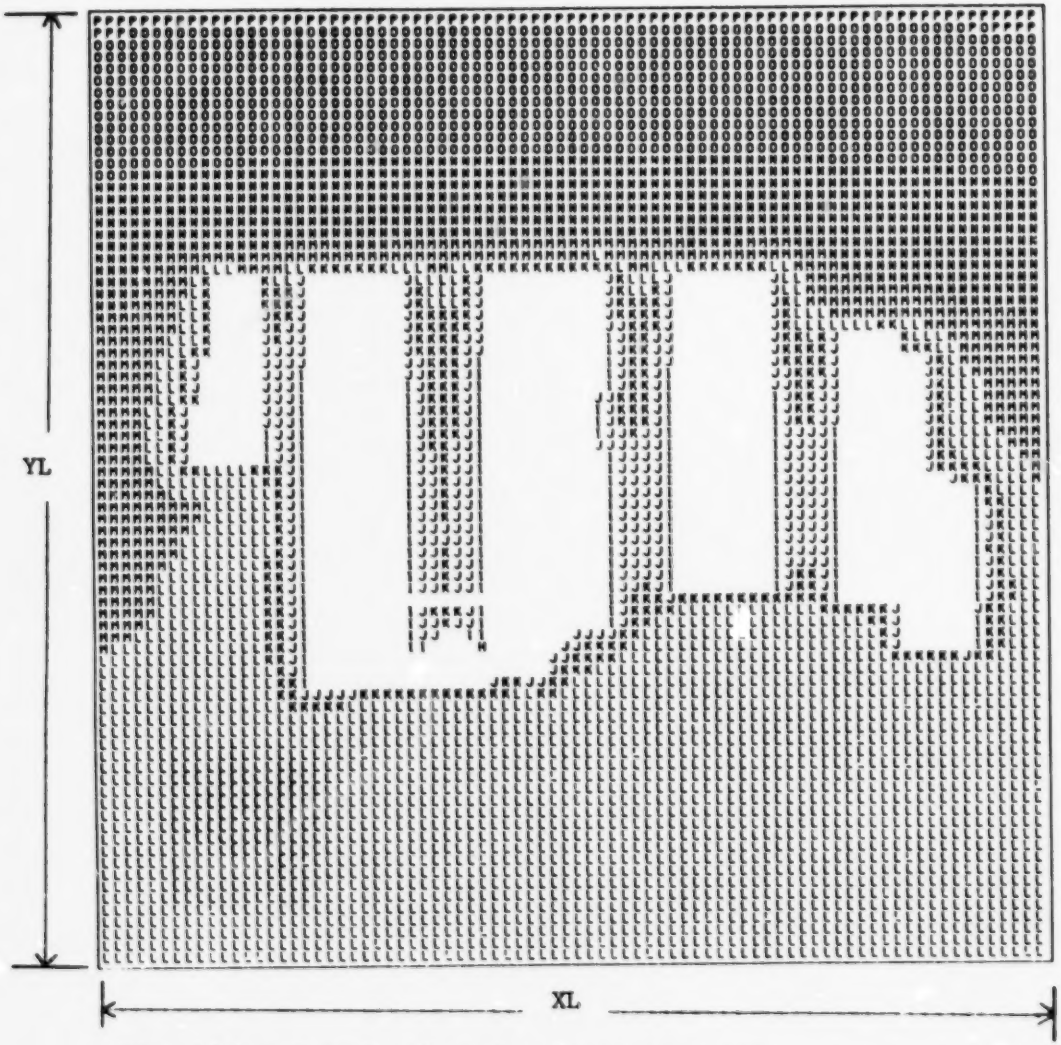
The authors would like to thank A.S. Wong for his assistance provided during the development and testing of this plotting program.

REFERENCES

1. Yu, Y.S., Toews, N.A. and Wong, A.S., "MINTAB User's Guide - A mining simulator for returning the elastic reponse of strats surroundig tabular mining excavations (version 2.0, 1981)"; Division Report MRP/MRL 81-131(TR), Mining Research Laboratories, CANMET, Energy, Mines and Resources Canada, 1981.

2. Hoek, E. and Brown, E.T., "Empirical strength criterion for rock masses"; J. Gotech. Eng. Division; Sept. 1980, ASCE.

S.S.R POINT CONTOUR - MINING STEP 3



SYMBOL	VALUE		
A	0.	-	2.000E-01
B	2.000E-01	-	4.000E-01
C	4.000E-01	-	6.000E-01
D	6.000E-01	-	8.000E-01
E	8.000E-01	-	1.000E+00
F	1.000E+00	-	1.200E+00
G	1.200E+00	-	1.400E+00
H	1.400E+00	-	1.600E+00
I	1.600E+00	-	1.800E+00
J	1.800E+00	-	2.000E+00
K	2.000E+00	-	2.200E+00
L	2.200E+00	-	2.400E+00
M	2.400E+00	-	2.600E+00
N	2.600E+00	-	2.800E+00
O	2.800E+00	-	3.000E+00
P	3.000E+00	-	3.200E+00

MINIMUM VALUE	=	0.
MAXIMUM VALUE	=	3.024E+00
CONTOUR INTERVAL	=	2.000E-01
COMP. STRENGTH	=	7.500E+01 MPA
CONSTANT M	=	1.700E+00
CONSTANT S	=	4.000E-03

PLTSIZ = MAX (XL,YL)

Fig. 1(a) - Example plot of point contour map

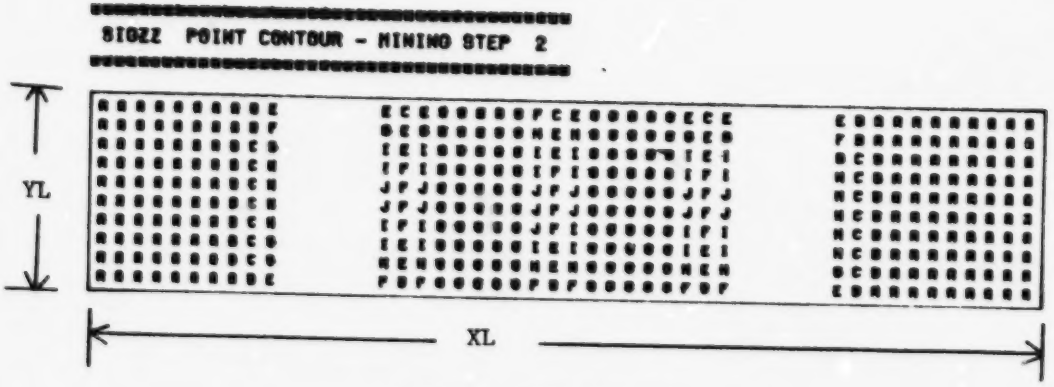


Fig. 1(b) - Example plot of point contour map.

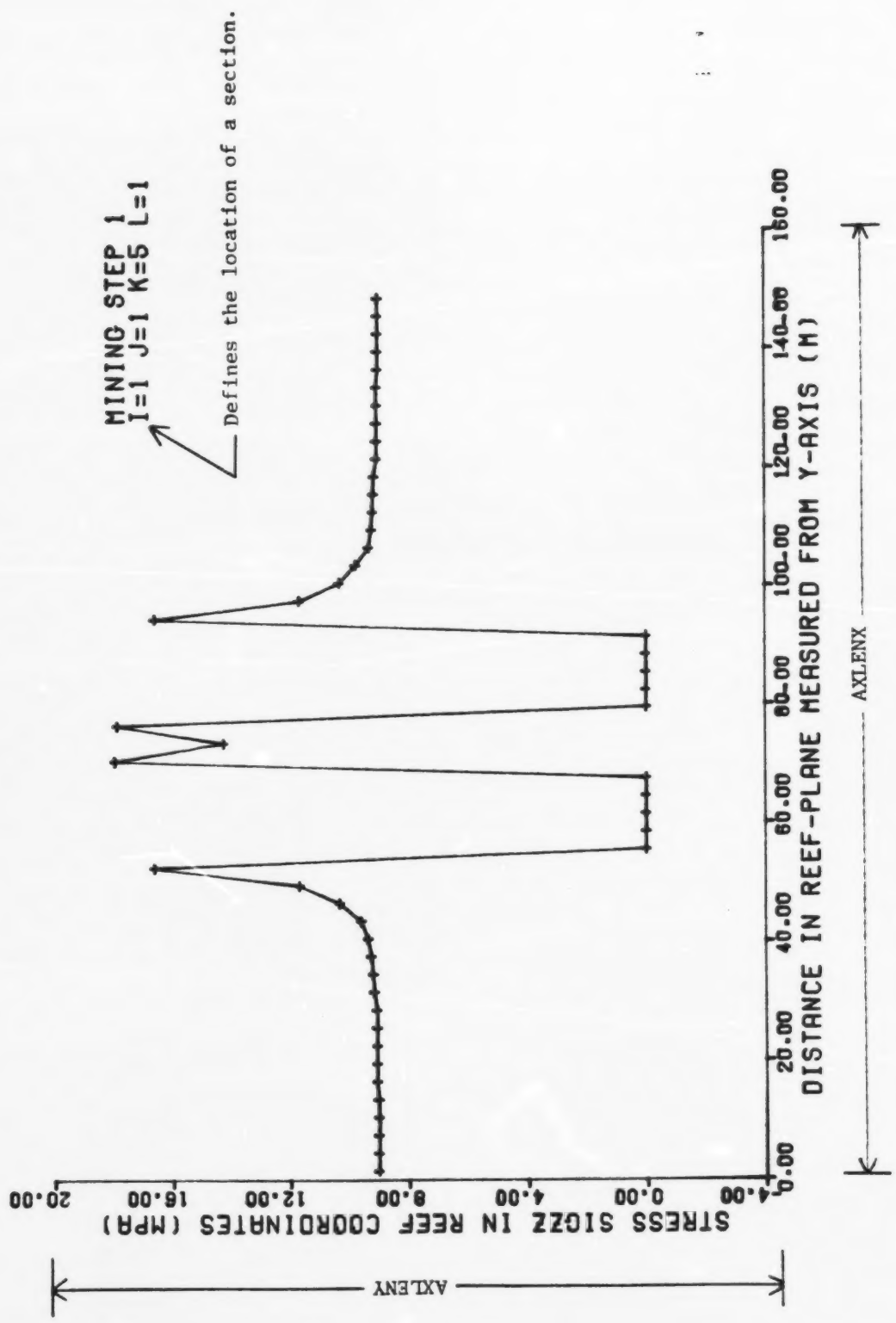


Fig. 2 - Example plot of graphs for a section along the strike direction.

APPENDIX A

FORTRAN SOURCE LISTING

```
      PROGRAM CNTPLT (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE10,      CNTPLT      2
     1                TAPE11)                                            CNTPLT      3
C     ********************************************************************* CNTPLT      4
C     A POST-PROCESSOR FOR MINTAB VERSION 2.0,1981.                       CNTPLT      5
C     THIS PROGRAM PROVIDES TWO TYPES OF PLOTS:                           CNTPLT      6
C      (A) POINT-CONTOUR-MAPS FOR ALL QUANTITIES AS CALCULATED FROM       CNTPLT      7
C          MINTAB PROGRAM PLUS THE PLOT OF A STRENGTH/STRESS RATIO MAP    CNTPLT      8
C      (B) GRAPHS OF THE QUANTITIES - RIDE/CLOSURE AND/OR STRESSES        CNTPLT      9
C          (NORMAL AND SHEAR STRESSES) FOR ANY SECTION ALONG THE STRIKE   CNTPLT     10
C          DIRECTION AND/OR ALONG THE DIP DIRECTION.                      CNTPLT     11
C     ********************************************************************* CNTPLT     12
      COMMON /PLTBUF/ BUFF(1025)                                          CNTPLT     13
      COMMON /A4/ QU,XM,XS                                                CNTPLT     14
      COMMON /B4/ ISTEP(9),IPLOT(11),NUMINT(11)                           CNTPLT     15
      COMMON /C4/ PI                                                      CNTPLT     16
      COMMON /D4/ ELMSIZ,PLTSIZ,AXLENX,AXLENY,ISEC                        CNTPLT     17
      COMMON /E4/ IX                                                      CNTPLT     18
C                                                                         CNTPLT     19
      CALL PLOTS (BUFF,1025)                                              CNTPLT     20
C                                                                         CNTPLT     21
      PI=4.*ATAN(1.)                                                      CNTPLT     22
      READ (5,1000) ELMSIZ,PLTSIZ,AXLENX,AXLENY,NCPLT                     CNTPLT     23
      READ(5,1100) (ISTEP(II),II=1,9)                                     CNTPLT     24
      READ(5,1200) (IPLOT(JJ),JJ=1,11)                                    CNTPLT     25
      IF(NCPLT.EQ.0) GO TO 110                                            CNTPLT     26
      WRITE(6,1350)                                                       CNTPLT     27
      READ(5,1300) (NUMINT(KK),KK=1,11)                                   CNTPLT     28
      IF(IPLOT(11).EQ.0) GO TO 100                                        CNTPLT     29
      READ(5,1400) QU,XM,XS                                               CNTPLT     30
C                                                                         CNTPLT     31
  100 CALL CNTOUR                                                         CNTPLT     32
C                                                                         CNTPLT     33
  110 READ (5,1500) NUMSEC                                                CNTPLT     34
      IF(NCPLT.EQ.0) WRITE(6,1650)                                        CNTPLT     35
      WRITE (6,1700) NUMSEC,AXLENX,AXLENY                                 CNTPLT     36
      IF(NUMSEC.EQ.0) GO TO 300                                           CNTPLT     37
C                                                                         CNTPLT     38
      CALL PLOT (2.,2.,-3)                                                CNTPLT     39
C                                                                         CNTPLT     40
      DO 200 II=1,NUMSEC                                                  CNTPLT     41
      READ(5,1600) ISEC,I,J,K,L                                           CNTPLT     42
      IX=II                                                               CNTPLT     43
      IF(ISEC.LT.0.OR.ISEC.GT.2) WRITE(6,1900)                            CNTPLT     44
      IF(ISEC.LT.0.OR.ISEC.GT.2) STOP                                     CNTPLT     45
      IF(ISEC.EQ.2) GO TO 120                                             CNTPLT     46
      J=1                                                                 CNTPLT     47
      L=1                                                                 CNTPLT     48
      GO TO 130                                                           CNTPLT     49
  120 I=1                                                                 CNTPLT     50
      K=1                                                                 CNTPLT     51
  130 CONTINUE                                                            CNTPLT     52
      WRITE (6,1800) II,ISEC,I,J,K,L                                      CNTPLT     53
      CALL GRAPH (I,J,K,L)                                                CNTPLT     54
  200 CONTINUE                                                            CNTPLT     55
  300 CALL PLOT (0.,0.,999)                                               CNTPLT     56
 1000 FORMAT(4F10.2,I5)                                                   CNTPLT     57
 1100 FORMAT (9I1)                                                        CNTPLT     58
```

```
      1200 FORMAT (1111)                                                    CNTPLT     59
      1300 FORMAT (111)                                                     CNTPLT     60
60    1350 FORMAT (1H1,32H POINT CONTOUR PLOT(S) REQUESTED/)                CNTPLT     61
      1400 FORMAT (3F10.2)                                                  CNTPLT     62
      1500 FORMAT (I5)                                                      CNTPLT     63
      1600 FORMAT (4X,I1,4I5)                                               CNTPLT     64
      1650 FORMAT (1H1)                                                     CNTPLT     65
65    1700 FORMAT (1H ,41H TOTAL NUMBER OF SECTIONS TO BE PLOTTED =,I5/     CNTPLT     66
     12X,40HLENGTH OF X-AXIS IN PLOTTING INCHES     =,F5.2/               CNTPLT     67
     22X,40HLENGTH OF Y-AXIS IN PLOTTING INCHES     =,F5.2/)              CNTPLT     68
      1800 FORMAT (1H ,2X,13HSECTION NO. =,I5,5X,6H ISEC=,I5,5X,3H I=,I5,5X,CNTPLT     69
     13H J=,I5,5X,3H K=,I5,5X,3H L=,I5)                                    CNTPLT     70
70    1900 FORMAT (1H1,20H  INPUT ERROR, ISEC=,I5)                          CNTPLT     71
           STOP                                                             CNTPLT     72
           END                                                              CNTPLT     73
```

```
      SUBROUTINE CNTOUR                                                 CNTOUR     2
C                                                                       CNTOUR     3
C     THIS ROUTINE PLOTS POINT CONTOURS IF REQUIRED                     CNTOUR     4
C                                                                       CNTOUR     5
      COMMON /A4/ QU,XM,XS                                              CNTOUR     6
      COMMON /B4/ ISTEP(9),IPLOT(11),NUMINT(11)                         CNTOUR     7
      COMMON /D4/ ELMSIZ,PLTSIZ,AXLENX,AXLENY,ISEC                      CNTOUR     8
      DIMENSION VALMAX(11),VALMIN(11),ITABLE(37),NPLOT(2,11),VALUE(11)  CNTOUR     9
      DATA ITABLE/1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ,1HK,1HL,1HM,  CNTOUR    10
     1            1HN,1HO,1HP,1HQ,1HR,1HS,1HT,1HU,1HV,1HW,1HX,1HY,1HZ,  CNTOUR    11
     2            1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H-,1H+/          CNTOUR    12
      DATA IBLNK,ISTAR/1H ,1H*/                                         CNTOUR    13
      DATA NPLOT /4H    ,2HDX,4H    ,2HDY,4H    ,2HDZ,4H SIG,2HZZ,      CNTOUR    14
     1            4H SIG,2HXX,4H SIG,2HYY,4H SIG,2HXY,4H SIG,2HYZ,      CNTOUR    15
     2            4H SIG,2HZX,4HENER,2HGY,4H S.S,2H.R/                  CNTOUR    16
C                                                                       CNTOUR    17
      REWIND 10                                                         CNTOUR    18
      READ (10) NSTEPS,NLSX,NLSY                                        CNTOUR    19
      NSSX=NLSX+5                                                       CNTOUR    20
      NSSY=NLSY+5                                                       CNTOUR    21
      XL=NSSX*ELMSIZ                                                    CNTOUR    22
      YL=NSSY*ELMSIZ                                                    CNTOUR    23
      WIDTH=AMAX1(XL,YL)                                                CNTOUR    24
      SCAL=PLTSIZ/WIDTH                                                 CNTOUR    25
      XL=XL*SCAL                                                        CNTOUR    26
      YL=YL*SCAL                                                        CNTOUR    27
      YDELT=0.10                                                        CNTOUR    28
      HT1=0.07                                                          CNTOUR    29
      HT2=0.05                                                          CNTOUR    30
C                                                                       CNTOUR    31
      CALL PLOT (1.,1.,-3)                                              CNTOUR    32
      NUMPLT=11                                                         CNTOUR    33
C                                                                       CNTOUR    34
      DO 250 NN=1,NSTEPS                                                CNTOUR    35
      IF(ISTEP(NN).EQ.0) GO TO 250                                      CNTOUR    36
C                                                                       CNTOUR    37
      CALL MAXMIN (NN,NLSX,NLSY,VALMAX,VALMIN,IPLOT)                    CNTOUR    38
      DO 240 N=1,NUMPLT                                                 CNTOUR    39
      REWIND 11                                                         CNTOUR    40
      IF (IPLOT(N).EQ.0) GO TO 240                                      CNTOUR    41
      IF (NN.EQ.1.AND.N.EQ.10) GO TO 240                                CNTOUR    42
C                                                                       CNTOUR    43
      CALL PLOT (0.,0.,2)                                               CNTOUR    44
      CALL PLOT (XL+HT2,0.,2)                                           CNTOUR    45
      CALL PLOT (XL+HT2,YL+HT2,2)                                       CNTOUR    46
      CALL PLOT (0.,YL+HT2,2)                                           CNTOUR    47
      CALL PLOT (0.,0.,2)                                               CNTOUR    48
C                                                                       CNTOUR    49
      X=0.                                                              CNTOUR    50
      Y=YL+5.*YDELT                                                     CNTOUR    51
      CALL PLOT (X,Y,3)                                                 CNTOUR    52
      DO 10 JX=1,40                                                     CNTOUR    53
      CALL SYMBOL (X,Y,HT1,ISTAR,0.0,1)                                 CNTOUR    54
      X=X+HT1                                                           CNTOUR    55
   10 CONTINUE                                                          CNTOUR    56
C                                                                       CNTOUR    57
      IF (NUMINT(N).EQ.0) NUMINT(N)=10                                  CNTOUR    58
```

```
      20 READ(11) NSTEP                                                  CNTOUR     59
         IF(NSTEP.EQ.NN) GO TO 40                                        CNTOUR     60
60    30 READ (11)                                                       CNTOUR     61
         IF (EOF(11).EQ.0.0) GO TO 30                                    CNTOUR     62
         GO TO 20                                                        CNTOUR     63
C                                                                        CNTOUR     64
      40 CONTINUE                                                        CNTOUR     65
65    C                                                                  CNTOUR     66
         IF (VALMAX(N).GT.(VALMIN(N)+1.E-7*ABS(VALMAX(N)))) GO TO 50     CNTOUR     67
         WRITE (6,1200) (NPLOT(I,N),I=1,2),VALMAX(N),VALMIN(N)           CNTOUR     68
         GO TO 240                                                       CNTOUR     69
      50 RANGE=VALMAX(N)-VALMIN(N)                                       CNTOUR     70
70       CNTINT=RANGE/NUMINT(N)                                          CNTOUR     71
         CALL SCALES (CNTINT,COEF,IEXP)                                  CNTOUR     72
      60 M=VALMIN(N)/CNTINT                                              CNTOUR     73
         IF (VALMIN(N).LT.0.) M=M-1                                      CNTOUR     74
         IF ((M+NUMINT(N))*CNTINT.GE.VALMAX(N)) GO TO 70                 CNTOUR     75
75       COEF=COEF*0.5                                                   CNTOUR     76
         CNTINT=COEF*10.**IEXP                                           CNTOUR     77
         GO TO 60                                                        CNTOUR     78
      70 CONTINUE                                                        CNTOUR     79
         X=0.                                                            CNTOUR     80
80       Y=YL+YDELT*3.5                                                  CNTOUR     81
         CALL PLOT (X,Y,3)                                               CNTOUR     82
         CALL SYMBOL (X,Y,HT1,NPLOT(1,N),0.0,4)                          CNTOUR     83
         CALL SYMBOL (999.,999.,HT1,NPLOT(2,N),0.0,4)                    CNTOUR     84
         CALL SYMBOL (999.,999.,HT1,29HPOINT CONTOUR - MINING STEP  ,0.,29) CNTOUR  85
85       CALL NUMBER (999.,999.,HT1,FLOAT(NN),0.0,-1)                    CNTOUR     86
         X=0.                                                            CNTOUR     87
         Y=YL+YDELT*2.                                                   CNTOUR     88
         DO 80 JX=1,40                                                   CNTOUR     89
         CALL SYMBOL (X,Y,HT1,ISTAR,0.0,1)                               CNTOUR     90
90       X=X+HT1                                                         CNTOUR     91
      80 CONTINUE                                                        CNTOUR     92
C                                                                        CNTOUR     93
         X=0.5*ELMSIZ*SCAL                                               CNTOUR     94
         HW=X                                                            CNTOUR     95
95    C                                                                  CNTOUR     96
         DO 160 LY=1,NLSY                                                CNTOUR     97
C                                                                        CNTOUR     98
C                                                                        CNTOUR     99
         DO 150 LX=1,NLSX                                                CNTOUR    100
100      DO 140 KY=1,5                                                   CNTOUR    101
         DO 140 KX=1,5                                                   CNTOUR    102
         READ (11) MINES,VALUE                                           CNTOUR    103
C                                                                        CNTOUR    104
         IF (MINES.EQ.0) MINES=10                                        CNTOUR    105
105      ICHAR=VALUE(N)/CNTINT-M+1                                       CNTOUR    106
         X=(5.*(FLOAT(LX)-1.)+FLOAT(KX)-1.)*ELMSIZ*SCAL+HW               CNTOUR    107
         Y=-(5.*(FLOAT(LY)-1.)+FLOAT(KY)-1.)*ELMSIZ*SCAL-HW              CNTOUR    108
         Y=YL+Y                                                          CNTOUR    109
C                                                                        CNTOUR    110
110      GO TO (90,90,90,100,90,90,90,100,100,110,100), M                CNTOUR    111
C                                                                        CNTOUR    112
C        PLOT DX,DY,DZ,SIGXX,SIGYY,SIGXY                                 CNTOUR    113
C                                                                        CNTOUR    114
      90 CALL SYMBOL (X,Y,HT2,ITABLE(ICHAR),0.0,1)                       CNTOUR    115
```

```
115               GO TO 140                                                    CNTOUR  116
                C                                                              CNTOUR  117
                C     PLOT SIGZZ,SIGXZ,SIGYZ,S.S.R                             CNTOUR  118
                C                                                              CNTOUR  119
                  100 IF (NINES.LE.NN) GO TO 140                               CNTOUR  120
120               CALL SYMBOL (X,Y,HT2,ITABLE(ICHAR),0.0,1)                    CNTOUR  121
                  GO TO 140                                                    CNTOUR  122
                C                                                              CNTOUR  123
                C     PLOT RELEASED ENERGY - ENERGY                            CNTOUR  124
                C                                                              CNTOUR  125
125               110 IF (NINES-NN) 140,130,120                                CNTOUR  126
                  120 CALL SYMBOL (X,Y,HT2,ISTAR,0.0,1)                        CNTOUR  127
                      GO TO 140                                                CNTOUR  128
                  130 CALL SYMBOL (X,Y,HT2,ITABLE(ICHAR),0.0,1)                CNTOUR  129
                C                                                              CNTOUR  130
130               140 CONTINUE                                                 CNTOUR  131
                  150 CONTINUE                                                 CNTOUR  132
                C                                                              CNTOUR  133
                  160 CONTINUE                                                 CNTOUR  134
                C                                                              CNTOUR  135
135             C     PLOT TABLE                                               CNTOUR  136
                C                                                              CNTOUR  137
                      X=XL+1.                                                  CNTOUR  138
                      Y=YL-0.50                                                CNTOUR  139
                      CALL SYMBOL (X,Y,HT1,10HSYMBOL    ,0.0,10)               CNTOUR  140
140                   CALL SYMBOL (999.,999.,HT1,10H     VALUE,0.0,10)         CNTOUR  141
                      Y=Y-3.*YDELT                                             CNTOUR  142
                C                                                              CNTOUR  143
                      NINT=NUMINT(N)                                           CNTOUR  144
                      DO 170 NX=1,NINT                                         CNTOUR  145
145                   XMIN=CNTINT*(N+NX-1)                                     CNTOUR  146
                      XMAX=CNTINT*(N+NX)                                       CNTOUR  147
                      IF (XMIN.GE.VALMAX(N)) GO TO 180                         CNTOUR  148
                      CALL SYMBOL (X,Y,HT1,3H   ,0.0,3)                        CNTOUR  149
                      CALL SYMBOL (999.,999.,HT1,ITABLE(NX),0.0,1)             CNTOUR  150
150                   CALL SYMBOL (999.,999.,HT1,4H    ,0.0,4)                 CNTOUR  151
                      CALL NUMBRE (999.,999.,HT1,XMIN,0.0,4)                   CNTOUR  152
                      CALL SYMBOL (999.,999.,HT1,3H - ,0.0,3)                  CNTOUR  153
                      CALL NUMBRE (999.,999.,HT1,XMAX,0.0,4)                   CNTOUR  154
                      Y=Y-YDELT                                                CNTOUR  155
155               170 CONTINUE                                                 CNTOUR  156
                  180 Y=Y-2.*YDELT                                             CNTOUR  157
                      IF (N.LE.3) GO TO 190                                    CNTOUR  158
                      IF (N.GE.4.AND.N.LE.9) GO TO 200                         CNTOUR  159
                      IF (N.EQ.10) GO TO 210                                   CNTOUR  160
160                   IF (N.EQ.11) GO TO 220                                   CNTOUR  161
                  190 CALL SYMBOL (X,Y,HT1,19HMINIMUM VALUE    = ,0.0,19)      CNTOUR  162
                      CALL NUMBRE (999.,999.,HT1,VALMIN(N),0.,4)               CNTOUR  163
                      CALL SYMBOL (999.,999.,HT1,2H M,0.0,2)                   CNTOUR  164
                      Y=Y-YDELT                                                CNTOUR  165
165                   CALL SYMBOL (X,Y,HT1,19HMAXIMUM VALUE    = ,0.0,19)      CNTOUR  166
                      CALL NUMBRE (999.,999.,HT1,VALMAX(N),0.,4)               CNTOUR  167
                      CALL SYMBOL (999.,999.,HT1,2H M,0.0,2)                   CNTOUR  168
                      Y=Y-YDELT                                                CNTOUR  169
                      CALL SYMBOL (X,Y,HT1,19HCONTOUR INTERVAL = ,0.0,19)      CNTOUR  170
170                   CALL NUMBRE (999.,999.,HT1,CNTINT,0.0,4)                 CNTOUR  171
                      CALL SYMBOL (999.,999.,HT1,2H M,0.0,2)                   CNTOUR  172
```

```
                GO TO 230                                                          CNTOUR   173
              200 Y=Y-YDELT                                                        CNTOUR   174
                  CALL SYMBOL (X,Y,HT1,19HMINIMUM VALUE    = ,0.0,19)              CNTOUR   175
175               CALL NUMBRE (999.,999.,HT1,VALMIN(N),0.,4)                       CNTOUR   176
                  CALL SYMBOL (999.,999.,HT1,4H MPA,0.0,4)                         CNTOUR   177
                  Y=Y-YDELT                                                        CNTOUR   178
                  CALL SYMBOL (X,Y,HT1,19HMAXIMUM VALUE    = ,0.0,19)              CNTOUR   179
                  CALL NUMBRE (999.,999.,HT1,VALMAX(N),0.,4)                       CNTOUR   180
180               CALL SYMBOL (999.,999.,HT1,4H MPA,0.0,4)                         CNTOUR   181
                  Y=Y-YDELT                                                        CNTOUR   182
                  CALL SYMBOL (X,Y,HT1,19HCONTOUR INTERVAL = ,0.0,19)              CNTOUR   183
                  CALL NUMBRE (999.,999.,HT1,CNTINT,0.0,4)                         CNTOUR   184
                  CALL SYMBOL (999.,999.,HT1,4H MPA,0.0,4)                         CNTOUR   185
185               GO TO 230                                                        CNTOUR   186
              210 Y=Y-YDELT                                                        CNTOUR   187
                  CALL SYMBOL (X,Y,HT1,19HMINIMUM VALUE    = ,0.0,19)              CNTOUR   188
                  CALL NUMBRE (999.,999.,HT1,VALMIN(N),0.,4)                       CNTOUR   189
                  CALL SYMBOL (999.,999.,HT1,7H MJ/M**M,0.0,7)                     CNTOUR   190
190               Y=Y-YDELT                                                        CNTOUR   191
                  CALL SYMBOL (X,Y,HT1,19HMAXIMUM VALUE    = ,0.0,19)              CNTOUR   192
                  CALL NUMBRE (999.,999.,HT1,VALMAX(N),0.,4)                       CNTOUR   193
                  CALL SYMBOL (999.,999.,HT1,7H MJ/M**M,0.0,7)                     CNTOUR   194
                  Y=Y-YDELT                                                        CNTOUR   195
195               CALL SYMBOL (X,Y,HT1,19HCONTOUR INTERVAL = ,0.0,19)              CNTOUR   196
                  CALL NUMBRE (999.,999.,HT1,CNTINT,0.0,4)                         CNTOUR   197
                  CALL SYMBOL (999.,999.,HT1,7H MJ/M**M,0.0,7)                     CNTOUR   198
                  GO TO 230                                                        CNTOUR   199
              220 Y=Y-YDELT                                                        CNTOUR   200
200               CALL SYMBOL (X,Y,HT1,19HMINIMUM VALUE    = ,0.0,19)              CNTOUR   201
                  CALL NUMBRE (999.,999.,HT1,VALMIN(N),0.,4)                       CNTOUR   202
                  Y=Y-YDELT                                                        CNTOUR   203
                  CALL SYMBOL (X,Y,HT1,19HMAXIMUM VALUE    = ,0.0,19)              CNTOUR   204
                  CALL NUMBRE (999.,999.,HT1,VALMAX(N),0.,4)                       CNTOUR   205
205               Y=Y-YDELT                                                        CNTOUR   206
                  CALL SYMBOL (X,Y,HT1,19HCONTOUR INTERVAL = ,0.0,19)              CNTOUR   207
                  CALL NUMBRE (999.,999.,HT1,CNTINT,0.0,4)                         CNTOUR   208
                  Y=Y-YDELT                                                        CNTOUR   209
                  CALL SYMBOL (X,Y,HT1,19HCOMP. STRENGTH   = ,0.0,19)              CNTOUR   210
210               CALL NUMBRE (999.,999.,HT1,QU,0.0,4)                             CNTOUR   211
                  CALL SYMBOL (999.,999.,HT1,4H MPA,0.0,4)                         CNTOUR   212
                  Y=Y-YDELT                                                        CNTOUR   213
                  CALL SYMBOL (X,Y,HT1,19HCONSTANT M       = ,0.0,19)              CNTOUR   214
                  CALL NUMBRE (999.,999.,HT1,XM,0.0,4)                             CNTOUR   215
215               Y=Y-YDELT                                                        CNTOUR   216
                  CALL SYMBOL (X,Y,HT1,19HCONSTANT S       = ,0.0,19)              CNTOUR   217
                  CALL NUMBRE (999.,999.,HT1,XS,0.0,4)                             CNTOUR   218
            C                                                                      CNTOUR   219
              230 X=2.0*XL                                                         CNTOUR   220
220               CALL PLOT (X,0.,-3)                                              CNTOUR   221
            C                                                                      CNTOUR   222
              240 CONTINUE                                                         CNTOUR   223
              250 CONTINUE                                                         CNTOUR   224
                  RETURN                                                           CNTOUR   225
225         C                                                                      CNTOUR   226
             1000 FORMAT   (11I1)                                                  CNTOUR   227
             1100 FORMAT   (11I5)                                                  CNTOUR   228
             1200 FORMAT   (1H1,5X,"DATA FOR",1X,A4,A2,1X,"IS IN ERROR AND WILL NOT  CNTOUR   229
```

```
      1BE PLOTTED"/6X,"VALMAX(N) =",E15.6/6X,"VALMIN(N) =",E15.6)          CNTOUR    230
230    END                                                                 CNTOUR    231
```

```
      SUBROUTINE SCALES (CNTINT,COEF,IEXP)                              SCALES     2
C                                                                       SCALES     3
C     THIS ROUTINE CALCULATES CONTOUR INTERVAL AND ROUNDED TO 2         SCALES     4
C     SIGNIFICANT FIGURES                                               SCALES     5
C                                                                       SCALES     6
      EXP=ALOG10(CNTINT)                                                SCALES     7
      IEXP=EXP                                                          SCALES     8
      IF (EXP.LT.0.0) IEXP=IEXP-1                                       SCALES     9
      COEF=10.**(EXP-IEXP)                                              SCALES    10
      COEF=IFIX((COEF+0.499999999)*2.)/2                                SCALES    11
      CNTINT=COEF*10.**IEXP                                             SCALES    12
      RETURN                                                            SCALES    13
      END                                                               SCALES    14
```

```
      SUBROUTINE NUMBRE (XPAGE,YPAGE,HT,FPN,ANGLE,NSIG)                 NUMBRE      2
C                                                                       NUMBRE      3
C     THIS ROUTINE IS SIMILAR TO THE CALCOMP NUMBER ROUTINE.  INSTEAD OF NUMBRE      4
C     PLOTTING A FLOATING POINT NUMBER IN FORTRAN F-TYPE FORMAT THE     NUMBRE      5
C     NUMBRE IS PLOTTED IN FORTRAN E-TYPE FORMAT.                       NUMBRE      6
C     EXCEPT FOR NSIG THE ARGUMENTS OF NUMBRE ARE IDENTICAL TO THE      NUMBRE      7
C     ARGUMENTS OF CALCOMP NUMBER.                                      NUMBRE      8
C                                                                       NUMBRE      9
C     NSIG - IS THE NUMBER OF SIGNIFICANT DIGITS PLOTTED.  NSIG MUST BE NUMBRE     10
C            GREATER THAN 0.                                            NUMBRE     11
C                                                                       NUMBRE     12
C       NOTES:                                                          NUMBRE     13
C         1.  THE NUMBER OF CHARACTERS PLOTTED IS ALWAYS 'NSIG+6'.      NUMBRE     14
C             EVEN IF A ZERO NUMBER IS PLOTTED THE PLOTTER WILL BE      NUMBRE     15
C             POSITIONED AFTER THE 'NSIG+6' CHARACTER BEFORE RETURNING  NUMBRE     16
C             TO CALLING PROGRAM.                                       NUMBRE     17
C         2.  ONLY A 2 DIGIT EXPONENT IS ALLOWED.  IF THIS IS EXCEEDED  NUMBRE     18
C             THEN '**' IS PLOTTED FOR EXPONENT.                        NUMBRE     19
C                                                                       NUMBRE     20
      DATA IBLANK,IPLUS,IMINUS / 1H ,1H+,1H- /                          NUMBRE     21
C                                                                       NUMBRE     22
C                                                                       NUMBRE     23
      NN=MAXO(NSIG,1)                                                   NUMBRE     24
      IF (FPN.NE.0.0) GO TO 20                                          NUMBRE     25
C     PLOT 0.0 NUMBER                                                   NUMBRE     26
      CALL SYMBOL (XPAGE,YPAGE,HT,3H 0.,ANGLE,3)                        NUMBRE     27
      NUM=NN-1+4                                                        NUMBRE     28
      DO 10 I=1,NUM                                                     NUMBRE     29
      CALL SYMBOL (999.,999.,HT,1H ,ANGLE,1)                            NUMBRE     30
   10 CONTINUE                                                          NUMBRE     31
      RETURN                                                            NUMBRE     32
C                                                                       NUMBRE     33
   20 Z=ALOG10(ABS(FPN))                                                NUMBRE     34
      IEXP=Z*(1.+1.E-7)                                                 NUMBRE     35
      IF (Z.LT.0.0) IEXP=Z+1.E-7-1.0                                    NUMBRE     36
      RMANT=10.**(Z-IEXP)                                               NUMBRE     37
C     PLOT SIGN                                                         NUMBRE     38
      ISIGN=IBLANK                                                      NUMBRE     39
      IF (FPN.LT.0.0) ISIGN=IMINUS                                      NUMBRE     40
      CALL SYMBOL (XPAGE,YPAGE,HT,ISIGN,ANGLE,1)                        NUMBRE     41
C     PLOT MANTISSA                                                     NUMBRE     42
      CALL NUMBER (999.,999.,HT,RMANT,ANGLE,NN-1)                       NUMBRE     43
C     PLOT E                                                            NUMBRE     44
      CALL SYMBOL (999.,999.,HT,1HE,ANGLE,1)                            NUMBRE     45
C     PLOT SIGN OF EXPONENT                                             NUMBRE     46
      ISIGN=IPLUS                                                       NUMBRE     47
      IF (IEXP.LT.0) ISIGN=IMINUS                                       NUMBRE     48
      CALL SYMBOL (999.,999.,HT,ISIGN,ANGLE,1)                          NUMBRE     49
C     PLOT EXPONENT                                                     NUMBRE     50
      IF (IABS(IEXP).GT.99) GO TO 40                                    NUMBRE     51
      IF (IABS(IEXP).GE.10) GO TO 30                                    NUMBRE     52
      CALL SYMBOL (999.,999.,HT,1H0,ANGLE,1)                            NUMBRE     53
   30 CALL NUMBER (999.,999.,HT,FLOAT(IABS(IEXP)),ANGLE,-1)             NUMBRE     54
      RETURN                                                            NUMBRE     55
C     EXPONENT .GT. 99 OR .LT. -99                                      NUMBRE     56
   40 CALL SYMBOL (999.,999.,HT,2H**,ANGLE,2)                           NUMBRE     57
C                                                                       NUMBRE     58
```

```
      RETURN                                                    NUMBRE     59
      END                                                       NUMBRE     60
```

```
      SUBROUTINE MAXMIN (NN,NLSX,NLSY,VALMAX,VALMIN,IPLOT)                  MAXMIN      2
C                                                                           MAXMIN      3
C     THIS ROUTINE FINDS MAXIMUM AND MINIMUM VALUES OF DISPLACEMENTS OR     MAXMIN      4
C        STRESSES FOR PLOTTING PURPOSE                                      MAXMIN      5
C                                                                           MAXMIN      6
      DIMENSION VALMAX(11),VALMIN(11),VALUE(11),IPLOT(11)                   MAXMIN      7
      DO 10 I=1,11                                                          MAXMIN      8
      VALMAX(I)=-1.0E10                                                     MAXMIN      9
   10 VALMIN(I)=+1.0E10                                                     MAXMIN     10
      VALUE(11)=0.0                                                         MAXMIN     11
C                                                                           MAXMIN     12
      REWIND 11                                                             MAXMIN     13
C                                                                           MAXMIN     14
   20 READ (10) ISTEP                                                       MAXMIN     15
      IF (EOF(10).NE.0.0) GO TO 20                                          MAXMIN     16
      IF (ISTEP.EQ.NN) GO TO 40                                             MAXMIN     17
   30 READ (10)                                                             MAXMIN     18
      IF (EOF(10).EQ.0.0) GO TO 30                                          MAXMIN     19
      GO TO 20                                                              MAXMIN     20
   40 WRITE (11) ISTEP                                                      MAXMIN     21
      DO 130 L=1,NLSY                                                       MAXMIN     22
      DO 120 I=1,NLSX                                                       MAXMIN     23
      DO 110 J=1,5                                                          MAXMIN     24
      DO 110 K=1,5                                                          MAXMIN     25
      READ (10) MINES,(VALUE(M),M=1,10)                                     MAXMIN     26
C                                                                           MAXMIN     27
      IF (IPLOT(11).NE.0) CALL SFACTR (VALUE)                               MAXMIN     28
C                                                                           MAXMIN     29
      WRITE (11) MINES,VALUE                                                MAXMIN     30
      DO 50 IX=1,3                                                          MAXMIN     31
      VALMIN(IX)=AMIN1(VALMIN(IX),VALUE(IX))                                MAXMIN     32
   50 VALMAX(IX)=AMAX1(VALMAX(IX),VALUE(IX))                                MAXMIN     33
      IF (MINES.NE.0.AND.MINES.LE.ISTEP) GO TO 60                           MAXMIN     34
      VALMIN(4)=AMIN1(VALMIN(4),VALUE(4))                                   MAXMIN     35
      VALMAX(4)=AMAX1(VALMAX(4),VALUE(4))                                   MAXMIN     36
   60 DO 70 IX=5,7                                                          MAXMIN     37
      VALMIN(IX)=AMIN1(VALMIN(IX),VALUE(IX))                                MAXMIN     38
   70 VALMAX(IX)=AMAX1(VALMAX(IX),VALUE(IX))                                MAXMIN     39
      IF (MINES.NE.0.AND.MINES.LE.ISTEP) GO TO 90                           MAXMIN     40
      DO 80 IX=8,9                                                          MAXMIN     41
      VALMIN(IX)=AMIN1(VALMIN(IX),VALUE(IX))                                MAXMIN     42
   80 VALMAX(IX)=AMAX1(VALMAX(IX),VALUE(IX))                                MAXMIN     43
   90 DO 100 IX=10,11                                                       MAXMIN     44
      VALMIN(IX)=AMIN1(VALMIN(IX),VALUE(IX))                                MAXMIN     45
  100 VALMAX(IX)=AMAX1(VALMAX(IX),VALUE(IX))                                MAXMIN     46
  110 CONTINUE                                                              MAXMIN     47
  120 CONTINUE                                                              MAXMIN     48
  130 CONTINUE                                                              MAXMIN     49
      RETURN                                                                MAXMIN     50
      END                                                                   MAXMIN     51
```

```
      SUBROUTINE SFACTR (VALUE)                                          SFACTR     2
C                                                                        SFACTR     3
C     A USER SUPPLIED ROUTINE                                            SFACTR     4
C     THIS ROUTINE CALCULATES THE STRENGTH/STRESS RATIO FOR EACH SMALL   SFACTR     5
C     SQUARE USING AN EMPIRICAL STRENGTH CRITERION                       SFACTR     6
C                                                                        SFACTR     7
      COMMON /C4/ PI                                                     SFACTR     8
      COMMON /A4/ QU,XM,XS                                               SFACTR     9
      DIMENSION VALUE(11)                                                SFACTR    10
C                                                                        SFACTR    11
      SZZ=VALUE(4)                                                       SFACTR    12
      SXX=VALUE(5)                                                       SFACTR    13
      SYY=VALUE(6)                                                       SFACTR    14
      SXY=VALUE(7)                                                       SFACTR    15
      SYZ=VALUE(8)                                                       SFACTR    16
      SXZ=VALUE(9)                                                       SFACTR    17
C                                                                        SFACTR    18
C     CALCULATES THE PRINCIPAL STRESSES                                  SFACTR    19
C                                                                        SFACTR    20
      TH1=SXX+SYY+SZZ                                                    SFACTR    21
      TH2=SXX*SYY+SXX*SZZ+SYY*SZZ-SXY*SXY-SXZ*SXZ-SYZ*SYZ                SFACTR    22
      TH3=SXX*SYY*SZZ+2.*SXY*SXZ*SYZ-SXX*SYZ*SYZ-SYY*SXZ*SXZ-SZZ*SXY*SXY SFACTR    23
      A=TH2/3.-TH1*TH1/9.                                                SFACTR    24
      B=(3.*TH3-TH1*TH2)/6.+TH1**3/27.                                   SFACTR    25
      FAC=ABS(A**3+B*B)                                                  SFACTR    26
      IF (B.NE.0.) GO TO 10                                              SFACTR    27
      TH=PI/2.                                                           SFACTR    28
      GO TO 20                                                           SFACTR    29
   10 TH=ATAN(SQRT(FAC)/B)                                               SFACTR    30
      IF (B.LT.0.) TH=TH+PI                                              SFACTR    31
   20 CONTINUE                                                           SFACTR    32
      A=ABS(A)                                                           SFACTR    33
      SINTH=SIN(TH/3.)                                                   SFACTR    34
      COSTH=COS(TH/3.)                                                   SFACTR    35
      SUM=2.*SQRT(A)*COSTH                                               SFACTR    36
      DIF=2.*SQRT(A)*SINTH                                               SFACTR    37
      DIF=SQRT(3.)*DIF                                                   SFACTR    38
      PS1=SUM+TH1/3.                                                     SFACTR    39
      PS2=-.5*SUM+TH1/3.-0.5*DIF                                         SFACTR    40
      PS3=-.5*SUM+TH1/3.+.5*DIF                                          SFACTR    41
      SIGMA1=AMAX1(PS1,PS2,PS3)                                          SFACTR    42
      IF (ABS(SIGMA1-PS1).GT.0.01) GO TO 30                              SFACTR    43
      SIGMA2=AMAX1(PS2,PS3)                                              SFACTR    44
      SIGMA3=AMIN1(PS2,PS3)                                              SFACTR    45
      GO TO 50                                                           SFACTR    46
   30 IF (ABS(SIGMA1-PS2).GT.0.01) GO TO 40                              SFACTR    47
      SIGMA2=AMAX1(PS1,PS3)                                              SFACTR    48
      SIGMA3=AMIN1(PS1,PS3)                                              SFACTR    49
      GO TO 50                                                           SFACTR    50
   40 SIGMA2=AMAX1(PS1,PS2)                                              SFACTR    51
      SIGMA3=AMIN1(PS1,PS2)                                              SFACTR    52
   50 CONTINUE                                                           SFACTR    53
C                                                                        SFACTR    54
C     EVALUATE STRENGTH/STRESS RATIO                                     SFACTR    55
C                                                                        SFACTR    56
      F3=SIGMA3/QU                                                       SFACTR    57
      F2=XM*F3+XS                                                        SFACTR    58
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```
      IF (F2.LT.0.0) GO TO 60                                    SFACTR  59
      ST=(F3+SQRT(F2))+QU                                        SFACTR  60
60    SSR=ST/SIGMA1                                              SFACTR  61
      GO TO 70                                                   SFACTR  62
   60 SSR=0.0                                                    SFACTR  63
   70 VALUE(11)=SSR                                              SFACTR  64
      RETURN                                                     SFACTR  65
65    END                                                        SFACTR  66
```

```
      SUBROUTINE GRAPH (I,J,K,L)                                        GRAPH      2
C                                                                       GRAPH      3
C     THIS ROUTINE PLOTS GRAPHS OF VARIOUS QUANTITIES FOR SECTIONS      GRAPH      4
C      EITHER ALONG THE STRIKE DIRECTION AND/OR ALONG THE DIP DIRECTION  GRAPH      5
C                                                                       GRAPH      6
      COMMON /B4/ ISTEP(9),IPLOT(11),NUMINT(11)                         GRAPH      7
      COMMON /D4/ ELMSIZ,PLTSIZ,AXLENX,AXLENY,ISEC                      GRAPH      8
      DIMENSION VALUE(82,9),DIST(82)                                    GRAPH      9
      DIMENSION VMAX(9),VMIN(9),ARRAY(4,9)                              GRAPH     10
C     ISEC= =1,DEFINES A SECTION ALONG THE STRIKE DIRECTION             GRAPH     11
C         =2,DEFINES A SECTION ALONG THE DIP DIRECTION                  GRAPH     12
C                                                                       GRAPH     13
      REWIND 10                                                         GRAPH     14
      READ(10) NSTEPS,NLSX,NLSY                                         GRAPH     15
      CALL SEARCH (NSTEPS,NLSX,NLSY,VMAX,VMIN)                          GRAPH     16
C                                                                       GRAPH     17
      REWIND 10                                                         GRAPH     18
      READ(10) NSTEPS,NLSX,NLSY                                         GRAPH     19
C                                                                       GRAPH     20
C                                                                       GRAPH     21
      NSSX=NLSX+5                                                       GRAPH     22
      NSSY=NLSY+5                                                       GRAPH     23
      AXLEN=AXLENY                                                      GRAPH     24
      X=AXLENX                                                          GRAPH     25
      XC=AXLENX+0.8                                                     GRAPH     26
      YC=AXLENY+0.9                                                     GRAPH     27
      HT=0.14                                                           GRAPH     28
      XI=I                                                              GRAPH     29
      XJ=J                                                              GRAPH     30
      XK=K                                                              GRAPH     31
      ZL=L                                                              GRAPH     32
      HW=0.50*ELMSIZ                                                    GRAPH     33
      NPTS=NSSX                                                         GRAPH     34
      IF(ISEC.EQ.2) NPTS=NSSY                                           GRAPH     35
C                                                                       GRAPH     36
      DO 50 II=1,NPTS                                                   GRAPH     37
      DIST(II)=HW+ELMSIZ*(II-1)                                         GRAPH     38
   50 CONTINUE                                                          GRAPH     39
C                                                                       GRAPH     40
C                                                                       GRAPH     41
      DO 250 NN=1,NSTEPS                                                GRAPH     42
      IF(ISTEP(NN).EQ.0) GO TO 250                                      GRAPH     43
      CALL NSTRES (NN,NLSX,NLSY,I,J,K,L,VALUE)                          GRAPH     44
C                                                                       GRAPH     45
      XN=NN                                                             GRAPH     46
      DO 245 II=1,9                                                     GRAPH     47
      IF(IPLOT(II).EQ.0) GO TO 245                                      GRAPH     48
      XPAGE=0.0                                                         GRAPH     49
      YPAGE=0.0                                                         GRAPH     50
      ANGLE=0.0                                                         GRAPH     51
      CALL SCALE (DIST,AXLENX,NPTS,1)                                   GRAPH     52
      IF(ISEC.EQ.2) GO TO 70                                            GRAPH     53
      CALL AXIS (XPAGE,YPAGE,47HDISTANCE IN REEF-PLANE MEASURED FROM Y-A GRAPH     54
     1XIS (M),-47,AXLENX,0.0,DIST(NPTS+1),DIST(NPTS+2))                 GRAPH     55
      GO TO 80                                                          GRAPH     56
   70 CONTINUE                                                          GRAPH     57
      CALL AXIS (XPAGE,YPAGE,47HDISTANCE IN REEF-PLANE MEASURED FROM X-A GRAPH     58
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     1XIS (M),-47,AXLENX,0.0,DIST(NPTS+1),DIST(NPTS+2))                    GRAPH     59
    80 ANGLE=90.                                                           GRAPH     60
60        C                                                                GRAPH     61
          ARRAY(1,II)=VMIN(II)                                             GRAPH     62
          ARRAY(2,II)=VMAX(II)                                             GRAPH     63
        C                                                                  GRAPH     64
          CALL SCALE (ARRAY(1,II),AXLEN,2,1)                               GRAPH     65
65        VALUE(NPTS+1,II)=ARRAY(3,II)                                     GRAPH     66
          VALUE(NPTS+2,II)=ARRAY(4,II)                                     GRAPH     67
          GO TO (110,120,130,140,150,160,170,180,190),II                   GRAPH     68
  110 CALL AXIS (XPAGE,YPAGE,12HRIDE DX (CM),12,AXLEN,ANGLE,VALUE(NPTS+1   GRAPH     69
     1,II),VALUE(NPTS+2,II))                                               GRAPH     70
70        GO TO 240                                                        GRAPH     71
  120 CALL AXIS (XPAGE,YPAGE,12HRIDE DY (CM),12,AXLEN,ANGLE,VALUE(NPTS+1   GRAPH     72
     1,II),VALUE(NPTS+2,II))                                               GRAPH     73
          GO TO 240                                                        GRAPH     74
  130 CALL AXIS (XPAGE,YPAGE,12HRIDE DZ (CM),12,AXLEN,ANGLE,VALUE(NPTS+1   GRAPH     75
75   1,II),VALUE(NPTS+2,II))                                               GRAPH     76
          GO TO 240                                                        GRAPH     77
  140 CALL AXIS (XPAGE,YPAGE,38HSTRESS SIGZZ IN REEF COORDINATES (MPA),    GRAPH     78
     1 38,AXLEN,ANGLE,VALUE(NPTS+1,II),VALUE(NPTS+2,II))                   GRAPH     79
          GO TO 240                                                        GRAPH     80
80  150 CALL AXIS (XPAGE,YPAGE,38HSTRESS SIGXX IN REEF COORDINATES (MPA),  GRAPH     81
     1 38,AXLEN,ANGLE,VALUE(NPTS+1,II),VALUE(NPTS+2,II))                   GRAPH     82
          GO TO 240                                                        GRAPH     83
  160 CALL AXIS (XPAGE,YPAGE,38HSTRESS SIGYY IN REEF COORDINATES (MPA),    GRAPH     84
     1 38,AXLEN,ANGLE,VALUE(NPTS+1,II),VALUE(NPTS+2,II))                   GRAPH     85
85        GO TO 240                                                        GRAPH     86
  170 CALL AXIS (XPAGE,YPAGE,38HSTRESS SIGXY IN REEF COORDINATES (MPA),    GRAPH     87
     1 38,AXLEN,ANGLE,VALUE(NPTS+1,II),VALUE(NPTS+2,II))                   GRAPH     88
          GO TO 240                                                        GRAPH     89
  180 CALL AXIS (XPAGE,YPAGE,38HSTRESS SIGYZ IN REEF COORDINATES (MPA),    GRAPH     90
90   1 38,AXLEN,ANGLE,VALUE(NPTS+1,II),VALUE(NPTS+2,II))                   GRAPH     91
          GO TO 240                                                        GRAPH     92
  190 CALL AXIS (XPAGE,YPAGE,38HSTRESS SIGZX IN REEF COORDINATES (MPA),    GRAPH     93
     1 38,AXLEN,ANGLE,VALUE(NPTS+1,II),VALUE(NPTS+2,II))                   GRAPH     94
  240 CALL LINE (DIST,VALUE(1,II),NPTS,1,1,3)                              GRAPH     95
95        CALL SYMBOL (XC,YC,HT,12HMINING STEP ,0.0,12)                    GRAPH     96
          CALL NUMBER (999.,999.,HT,XN,0.0,-1)                             GRAPH     97
          Y=YC-0.20                                                        GRAPH     98
          CALL SYMBOL (XC,Y,HT,2HI=,0.0,2)                                 GRAPH     99
          CALL NUMBER (999.,999.,HT,XI,0.,-1)                              GRAPH    100
100       CALL SYMBOL (999.,999.,HT,3H J=,0.0,3)                           GRAPH    101
          CALL NUMBER (999.,999.,HT,XJ,0.,-1)                              GRAPH    102
          CALL SYMBOL (999.,999.,HT,3H K=,0.0,3)                           GRAPH    103
          CALL NUMBER (999.,999.,HT,XK,0.,-1)                              GRAPH    104
          CALL SYMBOL (999.,999.,HT,3H L=,0.0,3)                           GRAPH    105
105       CALL NUMBER (999.,999.,HT,ZL,0.,-1)                              GRAPH    106
          CALL PLOT (X+39,0.0,-3)                                          GRAPH    107
  245 CONTINUE                                                             GRAPH    108
  250 CONTINUE                                                             GRAPH    109
          RETURN                                                           GRAPH    110
110       END                                                              GRAPH    111
```

```
      SUBROUTINE NSTRES (NN,NLSX,NLSY,I,J,K,L,VALUE)                    NSTRES     2
C                                                                       NSTRES     3
C     THIS ROUTINE LOCATES AND READS IN APPROPRIATE DATA FOR PLOTTING   NSTRES     4
C                                                                       NSTRES     5
      COMMON /D4/ ELMSIZ,PLTSIZ,AXLENX,AXLENY,ISEC                      NSTRES     6
      COMMON /E4/ NC                                                    NSTRES     7
      DIMENSION VALUE(82,9)                                             NSTRES     8
C                                                                       NSTRES     9
C                                                                       NSTRES    10
   20 READ(10) NSTEP                                                    NSTRES    11
      IF(EOF(10).NE.0.0) GO TO 20                                       NSTRES    12
      IF(NSTEP.EQ.NN) GO TO 40                                          NSTRES    13
   30 READ(10)                                                          NSTRES    14
      IF(EOF(10).EQ.0.0) GO TO 30                                       NSTRES    15
      GO TO 20                                                          NSTRES    16
   40 CONTINUE                                                          NSTRES    17
      IF(ISEC.EQ.2) GO TO 200                                           NSTRES    18
      IF(ISEC.EQ.1) GO TO 60                                            NSTRES    19
      WRITE(6,1000) ISEC                                                NSTRES    20
 1000 FORMAT(1H1," SECTION DEFINITION IS INCORRECT - ISEC =",I5)         NSTRES    21
C                                                                       NSTRES    22
C     SEARCH VALUES FOR A SECTION ALONG THE STRIKE DIRECTION            NSTRES    23
   60 J=1                                                               NSTRES    24
      L=1                                                               NSTRES    25
C                                                                       NSTRES    26
      NREC=NLSX*25*(I-1)+(K-1)*5                                        NSTRES    27
      DO 70 KL=1,NREC                                                   NSTRES    28
      READ(10)                                                          NSTRES    29
   70 CONTINUE                                                          NSTRES    30
C                                                                       NSTRES    31
      II=0                                                              NSTRES    32
      DO 100 KL=1,NLSX                                                  NSTRES    33
      DO 80 LM=1,5                                                      NSTRES    34
      II=II+1                                                           NSTRES    35
      READ(10) MINES,(VALUE(II,JJ),JJ=1,9)                             NSTRES    36
      VALUE(II,1)=VALUE(II,1)*100.0                                     NSTRES    37
      VALUE(II,2)=VALUE(II,2)*100.0                                     NSTRES    38
      VALUE(II,3)=VALUE(II,3)*100.0                                     NSTRES    39
   80 CONTINUE                                                          NSTRES    40
      IF(II.GE.NLSX*5) GO TO 300                                        NSTRES    41
      DO 90 ML=1,20                                                     NSTRES    42
      READ(10)                                                          NSTRES    43
   90 CONTINUE                                                          NSTRES    44
  100 CONTINUE                                                          NSTRES    45
C                                                                       NSTRES    46
      GO TO 300                                                         NSTRES    47
C                                                                       NSTRES    48
C     SEARCH VALUES FOR A SECTION ALONG THE DIP DIRECTION               NSTRES    49
  200 I=1                                                               NSTRES    50
      K=1                                                               NSTRES    51
C                                                                       NSTRES    52
      NREC=(J-1)*25+(L-1)                                               NSTRES    53
  210 DO 250 KL=1,NREC                                                  NSTRES    54
      READ(10)                                                          NSTRES    55
  250 CONTINUE                                                          NSTRES    56
C                                                                       NSTRES    57
      II=0                                                              NSTRES    58
```

```
                DO 290 KL=1,NLSY                                        NSTRES     59
                DO 270 LM=1,5                                           NSTRES     60
60              II=II+1                                                 NSTRES     61
                READ(10) MINES,(VALUE(II,JJ),JJ=1,9)                    NSTRES     62
                VALUE(II,1)=VALUE(II,1)*100.0                           NSTRES     63
                VALUE(II,2)=VALUE(II,2)*100.0                           NSTRES     64
                VALUE(II,3)=VALUE(II,3)*100.0                           NSTRES     65
65              IF(II.GE.NLSY*5) GO TO 300                              NSTRES     66
                DO 260 KK=1,4                                           NSTRES     67
                READ(10)                                                NSTRES     68
            260 CONTINUE                                                NSTRES     69
            270 CONTINUE                                                NSTRES     70
70          C                                                           NSTRES     71
                NREC=(NLSX-1)*25                                        NSTRES     72
                DO 280 ML=1,NREC                                        NSTRES     73
                READ(10)                                                NSTRES     74
            280 CONTINUE                                                NSTRES     75
75          290 CONTINUE                                                NSTRES     76
            300 CONTINUE                                                NSTRES     77
            400 RETURN                                                  NSTRES     78
                END                                                     NSTRES     79
```

```
      SUBROUTINE SEARCH (NSTEPS,NLSX,NLSY,VMAX,VMIN)                    SEARCH     2
C                                                                       SEARCH     3
C     THIS ROUTINE SEARCHES THE MAXIMUN AND MINIMUM VALUES OF ALL THE   SEARCH     4
C      QUANTITIES - RIDE/CLOSURE AND STRESSES FOR PLOTTING GRAPHS       SEARCH     5
C                                                                       SEARCH     6
      DIMENSION VMAX(9),VMIN(9),VALUE(9)                                SEARCH     7
C                                                                       SEARCH     8
      DO 10 I=1,9                                                       SEARCH     9
      VMAX(I)=-1.0E10                                                   SEARCH    10
   10 VMIN(I)=+1.0E10                                                   SEARCH    11
C                                                                       SEARCH    12
      NCNT=0                                                            SEARCH    13
   20 READ(10) NSTEP                                                    SEARCH    14
      IF(EOF(10).NE.0.0) GO TO 20                                       SEARCH    15
      DO 130 L=1,NLSY                                                   SEARCH    16
      DO 120 I=1,NLSX                                                   SEARCH    17
      DO 110 J=1,5                                                      SEARCH    18
      DO 110 K=1,5                                                      SEARCH    19
      READ(10) MINES,(VALUE(M),M=1,9)                                   SEARCH    20
      VALUE(1)=VALUE(1)*100.                                            SEARCH    21
      VALUE(2)=VALUE(2)*100.                                            SEARCH    22
      VALUE(3)=VALUE(3)*100.                                            SEARCH    23
      DO 100 N=1,9                                                      SEARCH    24
      VMAX(N)=AMAX1(VMAX(N),VALUE(N))                                   SEARCH    25
  100 VMIN(N)=AMIN1(VMIN(N),VALUE(N))                                   SEARCH    26
  110 CONTINUE                                                          SEARCH    27
  120 CONTINUE                                                          SEARCH    28
  130 CONTINUE                                                          SEARCH    29
      NCNT=NCNT+1                                                       SEARCH    30
      IF(NCNT.LT.NSTEPS) GO TO 20                                       SEARCH    31
      RETURN                                                            SEARCH    32
      END                                                               SEARCH    33
```